

### Global Water System Project

Integrated Studies of the Water Cycle



### Global Water System Project: U.S. Working Group Contributions

Charles Vörösmarty (GWSP Co-Chair)

NEWS PI Kick-Off Meeting NASA-GISS 7 September 2005

A Collaboration of the Global Environmental Change Programmes









A joint project w/ financial support from:









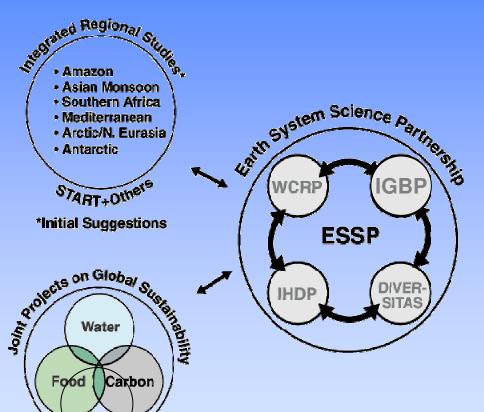






## Global Water System Project (GWSP)

-- From Planning to Execution--



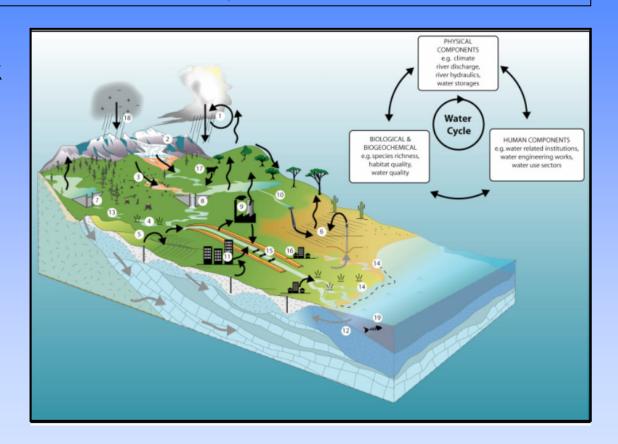
- 4-yr int'l planning effort; ~200 contributors
- GECP consultations, regional planning meetings
- OSC (Portsmouth, NH; Oct. 03)
   broad agency sponsorship
- IPO Bonn established late '03
- Science Framework & SSC approved '04
- SSC meetings Feb. & Sept. '05
- Dozen "Fast-Track Activities" identified and initiated





### The Notion of a Global Water System

- Change is a hallmark of the modern hydrologic cycle
- Both natural and human dimensions
- GWSP seeks to "co-balance" physical, BGC, biological, social science approaches











### **CENTRAL TENET OF THE GWSP**

Humans are changing the global water system in a globallysignificant way, but without.....adequate knowledge of the system and thus its response to change

GWSP is Science-Driven but Policy-Informing and organized around 3 science themes:

- 1. Quantify change and its sources
- 2. Uncover feedbacks in the global water system
- 3. Assess system adaptation and resilience







VOLUME 85 NUMBER 48 30 NOVEMBER 2004 PAGES 509-520

#### Humans Transforming the Global Water System

http://www.gwsp.org/

The Global Water System Challenge

System Science Partnership (ESSP).

For further information:

 Download <u>Powerpoint Presentation</u> ( approx. 3MB) Download GWSP brochure (700KB)

www.gwsp.org

DIVERSITAS IGBP IHDP WCRP

GLOBAL WATER SYSTEM PROJECT

Water is essential to life on earth, plays a key role in the development and functioning of

society and is recognised as a high priority resource for sustainable development. Over the

past few decades, environmental science has produced insights into the linkages,

interconnections and interdependencies in the global water cycle. The various human and

The global water system is being transformed by major syndromes including climate change,

erosion, pollution and salinisation. We know more about the physical aspects of the global

water system and much less about the nutrient flows, biodiversity loss and human

The Global Water System Project (GWSP) is a newly established joint project of DIVERSITAS, an international programme of biodiversity science, the International Geosphere-Biosphere

Programme (IGBP), the International Human Dimensions Programme (IHDP) and the World

Climate Research Programme (WCRP). These four global change programmes form the Earth

ork Document ( approx. 2MB )

physical, biochemical, and biological facets of the cycle make up the global water system.

New Tab GWSP Home page

Who's Who in GWSP

many ne: +49 228 73 6188 : +49 228 73 60834

What's New

**Publications** 

Contact

Links

Login

was was rigues prominently in the machinery of the Earth system and is key to understanding the full scope of global change. Greenhouse warming with a potentially accelerated hydro-logic cycle is already a well articulated science. issue, with strong policy implications. A broad array of other arithropogenic factors—wide-spread land cover change, engineering of river channels, irrigation and other consumptive channels, intigation and other consumptive losses, aqualit habitat desperanno, and pol-lution—also influences the water system in direct and inportant ways. A fich history of stoeped the research demonstrates the dear impact of such factors on local environments. Evidence now showe that humans are uptity. Intervening in the basic character of the water cycle over much broader domains. The collective significance of these many transformations on both the Eath system and human stockly smalrs-fundamentally unknown (Humby Committee of

The Notion of a Global Water System

Diminuitive by ocean standards and repre-senting but a small fraction of the planet's hydrosphere (< 3% of total volume [Shikhbermon and Rodda, 2003]), fresh water nonetheless serves as an essential building block of the

Parth sistem Fresh water is ini energy exchange, atmospheric lek-and feedbacks. Inthing the clima Water movement constitutes the of any material through the blos serves as the primary vehicle to dissolution of the continents. To of fresh water, which strongly re productivity and supports ecos blockversity is evident throughout Fresh water is also critical to it

By C. Vitalismouth: D. Letties R. NAIMAN, AS MEMBERS OF THE FRAI OF THE CLORAL WATER SYSTEM PROJ

aquacunue depend. Domestic, monstrat, hydropowegand recreational water use is crucial to a large and growing population that aspires to long-term improvements in well-being. Providing basic sanitation and clean chinking Providing basic sanilation and clean chinding water services smarters among public basilit challenge More than 1 billion people are without access to clean chinding valete 2.5 billion are without surfaillor, and over 5,000 people, mostly children, de each day from water-related darthout dessars [World Water Assessment Programme, 2003]. Key manifestions of variability in the lost.

Key manifestations of variability in the terrestrial water cycle continue to shape human history and are a costly source of vulnerability in the United States, annual drought damage wenges \$6 billion, with the 1988 drought alone costing over \$60 billion in 2002 dollars [Ross and Lot, 2003]. Annual clamages from flooding and other edisme weather involving the global water cycle are even more costy/initial estimates in press reports put losses from the 2004 humicane season in the tens of billions of

In the context of waters many roles in the Earth system, the concept of a Global Water System (GWS) provides a useful organizing framework. The GWS is defined by a series of interacting components (Figure 1):(1) water that its forms aspart of the physical hydrologic

and World Climale Research Programme [WCRP]) and would chrose research Programme (WCRF)
has been launched to study these complex
bases. The primary aim of the Global Water
System Project (CWSP) is to promote improved
understanding of fresh water in the Earth system through integrated study of its interactions, leedbades, and thresholds. The GWSP science agenda emerged from a broad consensu. of the water science and assessment community of the water science and assessment communy with more than 200 contributors to interdisci-plinary planning meetings starting in 2002 sci-ence planning documents, and a recent Open Science Conference (October 2003; Portsmouth New Hampshire). A peerreviewed framework and implementation plan consolidates these deliberations [Florning Committee of the GWSP, 2004]. This article presents the scientific nationale for the GWSP the project's key research questions, and an emerging agenda

for the decade-long effort.

In the crowded landscape of acronyms representing projects, programs, and institution representing projects, programs, and instantions that deal with water; a strong justification must accompany any new international initiative. Several characteristics distinguish the CW3P from other international water-related programs. The GWSP is designed to be the following: (1) Science detain but policy-informing GWS1

(1) sounce orners our poucy-informing. Owen considers fundamental questions about water and global change. Owing to the central role of water in human so dely the questions bear high relevance to environmental management and sustainable development. (2) Giobal in its perspective. GWSP will help

delermine the importance of pandemic local changes to the hydrologic cycle on the behavior

Fos Vol. 85 No. 48 30 November 2004

nas been n of sta-

raining\*



ESSP Report No.3

**GWSP Report No.1** 

Water **System** 







www.gwsp.org



Implementation Activities



Fig. 1. The Object little of points make makes conditional in complex consignment per de-dications, this internal complex content can admiss by the origins. Despired may call biology of the primal, the produced regions of the model, these pointers have been breaked and conditional terrorial admiss about the man information in the user's open, the internal three complex makes makes requires an integrated, their disciplinary perspective that counts there complex makes makes requires an integrated, their disciplinary perspective that counts the counts of the counts of the disciplinary perspective.

exionit, yet we tack an ade-ig of how the overall system onds to change, and how and surprises, such as a potential shuidown of North Atlantic cleep water formation and ocean circulation arising from changes in Eurasian adapt to rapidly-evolving and system states. The GWSP is river discharge, or the emergence of an oxid dead zones near the mouths of rivers leavily political by updrawn agriculture and urban-tation [Routing Committee of the GMSP 2004]. The GMSP is supported by three framing questions, which form its thiomatic structure; Question ! Which are the magnitudes of antihopogenic and emboraneously disappears to GMSP and what make the common characteristic. ires this assertion in a nilled manner. A special Sciences I Putil-Wood et al.

our collective capacity for act objective, which must not, water resource manage ophysical perspectives in the GWS, and what are the bay mechanisms by which they are induced? This question is dedsuccess. age point, the GW3 can be led system, with equal altenicated to first quantitying the principal indicaicas of insignativing the principal indica-tors of charge to the global hydrologic cycle and then estigning causality. In general, the mechanisms by which changes have occurred in the physical components of the GWS are better understood than in its biogeochemical e paidto is physical, chemical e paidto is priyastal, chemical, nithropogenic components, needs to deline how humans, this water system beyond ming atone, and to determine ad impact of a much broader and biological dimensions A major challenge is to identify the unique role of human versus rived changes has moved the range of material variability to rate. Libs other components of mitural sources of variability and change.

Ouesfor 2:What are the main linkness and the GWS could also have sta-

Questor 2: What are the main linkages and leastbacks within the Earth system arthring form a changing GWS? knowledge from Question 1 will formally be linked to synthesis studies almed all uncovering interactions among GWS components, their sensitivities, and responses

The Global

Project







Science Framework and

# Present vegetation PARTICULARLY

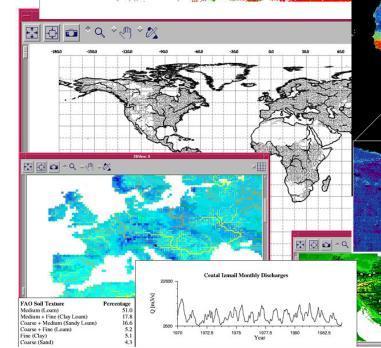
**NASA-"NEWS-WORTHY"** 

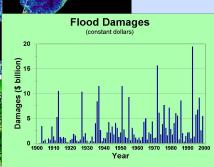
### Potential U.S. Contributions to GWSP

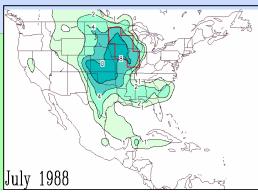
- Operational and satellite-based monitoring of the hydrosphere
- Simulation models (NWP, 4DDA, GCMs, RCMs, ESMs)
- Education and outreach: Training new generation of thinkers in integrative, broad-scale science
- Policy assessment

In turn, GWSP Can Contribute

- Global and regional partners
  - Interdisciplinary and integrative context
    - Int'l policy dialogue







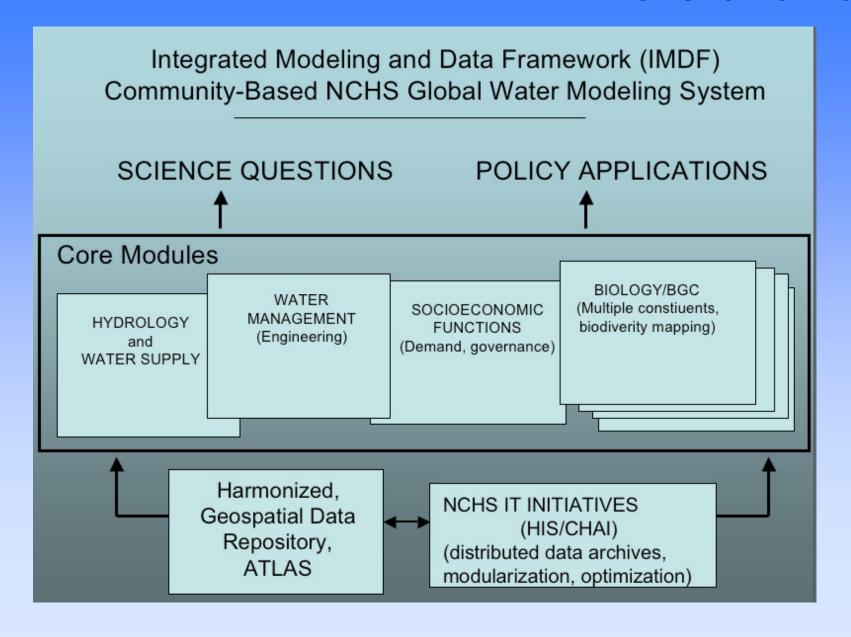
## Invitation by CUAHSI National Center for Hydrologic Synthesis (NCHS) (UC Berkeley) to form a Global Water Science Working Group

OVERALL SCIENCE THEME OF GWS-WG: To quantify the collective, systemic, and global-scale significance of widespread change to the hydrology of the planet, identifying the natural and anthropogenic agents of such change by

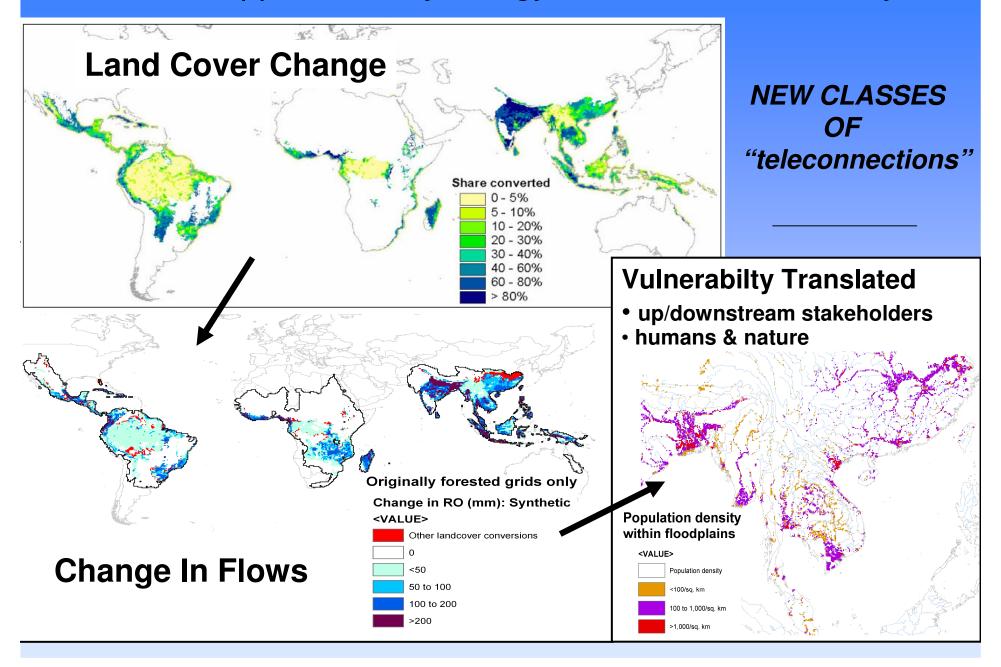
- Developing a prototype integrated modeling & data framework (IMDF) for global-scale water system experiments
- Applying this framework to identify & rank in importance the major forces shaping the contemporary global water system
- Assessing the impacts of a changing water system on society and ecosystems.

\*Consortium of Universities for the Advancement of Hydrologic Science, Inc.

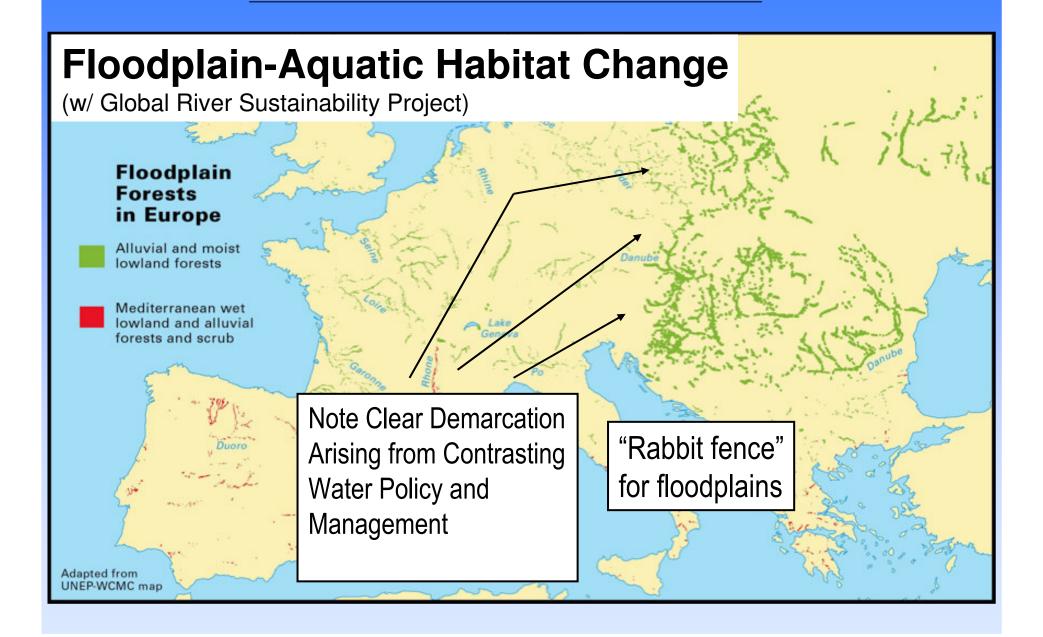
### NCHS: GWS-WG



### GWS-WG Application: Hydrology & Societal Vulnerability



### GWS-WG Application: Environmental Flows & Biodiversity



### Working Group Membership: GWS-WG

### Core planning group:

- Charles Vörösmarty (lead) (University of NH) (macroscale hydrology, water resources, biogeochemistry)
- Dennis Lettenmaier (physical hydrology & water management) (U. Washington)
- Robert Naiman (U. Washington) (aquatic ecology & environmental flows)
- Sybil Seitzinger (Rutgers U.) (biogeochemistry)
- Marc Levy (Columbia U.) (socioeconomic sciences)

### Working Group Membership: GWS-WG

### Expansion anticipated & welcome:

- Mandate of NCHS community-based efforts
- •Clear articulation of hydrologic cycle (stocks and dynamics) is "backbone" of effort
- NASA-NEWS research projects would provide a rich porfolio of science studies and expertise pool for developing integrated framework and component modules
- NCHS GWS-WG provides a concrete point of engagement for GWSP-NEWS collaboration, w/ tangible assets (post-docs, IT & WG support)
- Proposal pending....stay tuned